IV. *On Artificial and Natural Arrangements of Plants: and particularly on the Systems of Linnæus and Jussieu. By William Roscoe, Esq. F.L.S.*

Read November 6th, 1810.

ORDINES NATURALES valent de *Natura* Plantarum;
ARTIFICIALES in *Diagnosi* Plantarum. LINN.

THAT nature has impressed upon the individuals of her vegetable kingdom characters sufficient to enable us, not only to distinguish them from each other, but to form them into their proper families and combinations, cannot be doubted. Nor will it be denied that the arrangement of a system of vegetables, founded upon true natural distinctions, would be in the highest degree gratifying. It is not therefore surprising that so many attempts have been made to accomplish this most desirable object; but attractive and splendid as it may be, and certainly as it is known to exist, it is not likely to be ever fully disclosed to our view.—"The majesty of nature" glances before our sight, but as often as we attempt to retain her, she eludes our efforts.—Her vegetable productions are so numerous, their characteristics often so difficult to ascertain, they are related to each other by so many

many ties, that it is in vain to expect that we shall ever be able clearly to define them, and accurately to seize upon the true distinctions; so as to combine the whole in the precise order in which they were primarily disposed by her hand. In the mean time, the necessities of human life, no less than the objects of science, require that some mode should be adopted which should enable us to distinguish plants from each other, and to designate them by their appropriate names, although we may not be able precisely to ascertain their natural connections and relative situations: and for this purpose it became indispensably necessary to have recourse to art; not to overthrow or oppose nature, but to assist us where she deserted us, to guide our steps till we could again recover her track, and to furnish us with a lamp till we were again illuminated by the beams of day.

Happily for the world, the formation of such a system was undertaken by the illustrious Swede whose name it bears; and certain it is, that it could not have fallen into abler hands.—With the conviction of the real existence of natural genera and orders, no one was more deeply penetrated; and to interfere with these relations as little as might be consistent with his primary object of a complete arrangement of the vegetable world, was his constant solicitude. For the creation of this system he did not, however, wholly depend upon the materials supplied by his predecessors. The systems of all of them were discarded, or only so much of each of them retained as appeared to suit his purpose; but the most valuable part was supplied from his own resources. To whatever period we may assign the discovery of the sexual system, it was he who first demonstrated it in unambiguous and decisive terms, and who applied this great discovery to the formation of an arrangement of Plants, which comprehends and defines every individual of the vegetable world. In executing

this great task, he has placed the science of Botany upon a firm and immoveable foundation ; and if he has at any time erred in the application of his own principles, it has been rather from an unconquerable reluctance to interfere, more than was necessary, with the dispositions of nature, than from the pride of erecting a system which should contravene her works.

That the system thus formed is an artificial, and not a natural one, must be admitted ; and that it was always so considered by Linnæus, is evident from all his works. Yet this characteristic is not to be taken without some limitations. And in the first place it may be observed, that by the mode of arrangement which he has adopted, the major part of all known vegetables are formed into their great natural combinations in such a manner as scarcely to be susceptible of further elucidation.—Again, the *genera* of Linnæus are uniformly natural ; or at least display such trivial exceptions as to oppose no objection of any moment ; and this purity in his genera may be considered as of the utmost importance to the character, not only of his own, but of any system. It is therefore only with respect to the place which each genus occupies in his system, that any solid objection can be made ; and if this be so situated as to be readily discovered, even although it may not in every instance be found amongst its nearest congeners, it is a defect which may be remedied by an accurate reference, and which as it is occasioned, so it must be excused, by the universality and facility of the system. It would perhaps be too much to say that such an arrangement could not have been effected with less violation of natural affinities ; but certain it is that with these affinities he was well acquainted, and the preservation of them was constantly in his view ; insomuch that, notwithstanding its acknowledged defects, it may, by a due attention to its exceptions, be studied as a natural system with considerable

considerable advantage; whilst, at the same time, it affords an universal key through every department of the vegetable world.

The approbation with which the arrangement of Linnæus was received on its promulgation, and the subsequent adoption of it into general use, may be considered as the most unequivocal testimonies of its excellence. It is true, exceptions have been taken against particular parts, and alterations suggested in departments of minor importance, even by the very editors of his works. To have expected perfection in the first outline of a science, the materials of which are continually increasing, would be unreasonable; and these alterations, instead of derogating from, do homage to the system which they correct. The period however is now arrived which is to try its stability.—A rival has of late risen up, and has already become truly formidable.—Under the patronage and by the influence of a neighbouring nation, this rival now comes forward, and demands universal homage. Its advocates are not only numerous, but learned; not only acute, but earnest.—That their influence is daily increasing cannot be doubted; and the crisis is now arrived when their opinions must be either submitted to, or resisted.

Notwithstanding the favourable reception given to the sexual arrangement of Plants, it is well known to have made but little progress through the southern nations of Europe; and the French in particular refused implicitly to admit the novel doctrines of the Swede. In Botany, Tournefort continued to be their guide. In Zoology, Buffon directed their steps; and their example induced the Italians, and in some degree the Germans, to follow the same track. From various circumstances, and particularly from the great accession of individuals of the vegetable kingdom

to

to which the arrangement of Tournefort is wholly incompetent, his authority has declined; but Linnæus has not always gained the followers that Tournefort has lost. Other leaders have risen up, and proposed arrangements and nomenclatures of plants wholly different from those of Linnæus; and in particular, the successive efforts of the distinguished family of Jussieu have raised a standard to which many of the most eminent botanists of the present day think it an honour to resort.

The system of the Jussieus, as originally proposed by Bernard, and afterwards illustrated and amplified by Antoine Laurent de Jussieu, has higher pretensions than that of Linnæus, and professes not only to unite together in their natural orders such plants as are related to each other, but to form a complete arrangement, in which every known plant may be found in its proper situation, and every unknown plant may when discovered take its place among its congeners. A system, in short, which unites all the advantages of a natural arrangement with the elucidation of a technical one; and comprises within itself all that is requisite to botanical science*. If such a system could be established, it is evident that it must render that of Linnæus of no value; or, rather, must exhibit it as calculated only to mislead the student, and amuse him with words, instead of communicating to him substantial knowledge.

In the execution of his task the younger Jussieu had peculiar advantages. Since the time of Linnæus the accessions to the science have been immense; not only from the introduction of new genera and species, which to him were wholly unknown, but from the greater attention which has been paid to the exa-

* "His genuina mox substituitur scientia, quæ vegetantium non modo *nomina*, sed et *naturam* inquirens integram eorum organisationem cunctos caracteres prospiciat, &c."
Jussieu, Introduc. p. 67.

mination

mination of the individuals of the vegetable kingdom; the modes of their existence, economy, and reproduction, and various other particulars connected with botanical studies. To enumerate merely the writers on these subjects whose works are entitled to approbation, would be to form a considerable catalogue. That the mass of information thus obtained has thrown great light on the physiology of plants, cannot be doubted; and no undertaking could be more commendable, or more worthy of the talents of the illustrious scholar who engaged in it, than that of endeavouring to apply such knowledge to general use, and showing the affinities and connections which nature has established between the individuals of her vegetable kingdom. The great utility of such a work is obvious; its foundations are deeply laid in the principles of nature; and in order to make a proficiency in such study, it is necessary to examine far beyond the exterior phænomena which are requisite for an artificial arrangement. Hence the science acquires new dignity; and, instead of being conversant merely with exterior forms and nominal distinctions, becomes acquainted with the laws and operations of nature in one of the most important of her functions; that by which she elicits from unorganized matter the means of support for animal life.

Of the ability with which Jussieu has executed his task, and the impulse which he has given to these pursuits, every botanical student is well informed; nor is it possible to recommend his writings, and those of several of his countrymen who have adopted, and perhaps improved upon his system, too earnestly to their attention, as elucidating the natural characters and relative connections of a considerable portion of the vegetable kingdom. This, however, is not the whole to which these authors lay claim

It

It is not sufficient that we admit, in its fullest extent, the expediency and utility of studying the natural arrangements of plants, but we are now required to adopt this new system as a general arrangement and nomenclature, in the stead of that of Linnæus; to discard his labours, as of an inferior and a succedaneous kind; and to hail the moment when the great event, which he is said to have himself considered as the destruction of his own system, has actually taken place.

It is true the triumph of the new system has not yet been announced, even by its warmest promoters, in distinct and unambiguous terms; but the very arrangement of a *Genera Plantarum*, like that of Jussieu, offers it to universal use; and the manner in which it is spoken of, both by him and his followers, sufficiently demonstrates that this is its ultimate object, to the total exclusion of that of Linnæus. In the very introduction to his work, Jussieu has himself sufficiently disclosed his views, by the objections which he has brought against the system of his illustrious predecessor; the tendency of which is not merely to show that it is imperfect when considered as a natural arrangement, but that even as an artificial one it is not entitled to a preference. In arranging these objections Jussieu has observed, "1. That the distinctions of the Linnæan system are sometimes founded on the minuter organs of vegetables, requiring the use of glasses and instruments. 2. That the method is arbitrary; the distinctions of his classes being derived from some one part only; and that from a deficiency of real characters he is compelled to adopt such as are inconstant, which he uses frequently and promiscuously, to the exclusion of those which are substantial. 3. That in determining by the number of stamina, not only genera nearly related to each other are frequently

frequently divided, but that even species are separated*." To these he adds many other objections of minor importance, and afterwards asserts, that "if a preference is to be given to that method which is the most easy, and the most agreeable to the order of nature, that of Tournefort is the most perfect; that the arrangement of the Linnæan system is sometimes perplexed, its designations difficult, and its connections of plants not related still more frequent; that it is indebted for its general reception among botanists to the conciseness and certainty of its characters, the number of individuals arranged under each order, and the improved nomenclature by generic and specific names†." To this, however, he adds, "that all such systems are arbitrarily constructed, that they exhibit a factitious science, terminating not in the knowledge, but merely in the defining and naming of plants; and that, in short, they can only be considered as a prelude to the science of botany, affording a succedaneous arrangement of plants, until, by repeated labours, they can be reduced into a proper and natural series‡."

* "Systema tenuissimis interdum innititur organis, oculo armato et acu divellente tunc difficilius observandis. 2. Præterea arbitrarium, systematico errore, dum multiplicatis classibus omnes earum designationes ex unicâ parte molitur depromere; tunc solidorum caracterum penuriâ essentialibus promiscuè addit inconstantes, quos etiam, utpote numerosiores frequentius usurpat, prioribus plerumque neglectis. 3. Staminum numero sic discrepant non tantum genera cognatissima, sed et species congeneres ab invicem demovere nesciæ, &c."—*Jussieu, Introd.* p. 40.

† *Jussieu, Introd.* p. 41.

‡ "Hæc autem systemata arbitrariò constructa, scientiam exhibent factitiam, non naturalem, et plantis non penitus cognoscendis, sed tantùm compendiosè definiendis ac certò nominandis addictam. Habenda sunt igitur quasi præludia botanica, aut repertoria aptè digesta, indicisque non alphabetici, alii aliis commodiores, in quibus, secundum signa in faciliorem propriæ investigationis labórem mutuique Botanicorum commercii nexum admissa pacto ordine disponuntur plantæ, donec feliciùs iterata meditatione in seriem verè naturalem distribuantur."—*Jussieu, Ibid.*

From these and other observations to be found in the writings of Jussieu, it is not difficult to perceive that the system there proposed was intended to replace that of Linnæus; which from that time was presumed to be no longer necessary to the student; and these pretensions have been enforced by subsequent writers, who have adopted the arrangements of Jussieu. In his Discourse on the Study of Botany, prefixed to his "*Tableau du Règne Végétal*," M. Ventenat has not only collected the authorities of several preceding botanists in derogation of the system of Linnæus, but has even made use of the authority of Linnæus against himself. In this, indeed, he has in some degree followed the example of Jussieu, who has availed himself of several passages from the writings of Linnæus to prove his acknowledgement of the superiority of a natural method*; but this concession has been carried by both these writers to an extent which Linnæus certainly never intended, and which it will not in any candid construction bear. If we admit the interpretation put upon the writings of Linnæus, he has himself acknowledged the futility and proclaimed the downfall of his own system, and has consequently released his followers from engaging in its defence.

"This system," says Ventenat, "has had its partisans and its critics. Some have said with Royenus,

"Si quid habent veri vatis præsagia, Floræ
Structa super lapidem non ruet hæcce domus;"

whilst others have not hesitated to assert with Alston, that the sexual system is full of difficulties, and that it is the least

* "Classes quo magis naturales, eo *ceteris paribus* præstantiores sunt. Summorum Botanicorum hodiernus labor in his sudat, et desudare decet.—Methodus naturalis hinc ultimus finis Botanices est et erit." *Linn. Phil. Bot. n.* 206.—"Primum et ultimum in Botanice quæsitus est methodus naturalis.—Hæc adeò a Botanicis minùs doctis vili habita, a sapientioribus verò tanti semper æstimata, licet detecta nondum &c."—*Linn. Class.* p. 485. *ap. Jussiæi Introd.* p. 43.

natural

natural of all those that have been invented for the classification of plants.

"At this period," continues M. Ventenat, "when experience has enabled us to appreciate the value of the sexual system, and envy and adulation are alike removed, we may assert, without fear of being suspected of partiality, that Linnæus has himself acknowledged the inconveniencies attending the sexual system. This man of genius did not suffer himself to be seduced by the delusions of self-love; and he has frankly acknowledged that his principles had sometimes compelled him to deviate from the track of nature.—Let us not however attach to the sexual method greater importance than was given to it by its author. Those who have read his works ought to know that artificial methods were only considered by him as introductory to the natural method.—In fact, the celebrated naturalist of Upsal was all his life a zealous defender of natural combinations, as may be proved, in the first place, by different axioms interspersed in his works. 2. In the *Eulogia* which he has conferred on those botanists who have endeavoured to follow the traces of nature. 3. In the fragments which he has left us of natural orders, and at which he never ceased to labour*." After quoting a passage from Linnæus in justification of these sentiments†, he adds, "It is remarkable that this great man, after having in his public lectures demonstrated plants according to the sexual system, in his private conferences with his most distinguished pupils developed the principles by which he had been guided in the esta-

* *Ventenat, Discours sur la Botanique.* V. *Tableau du Règne Végétal,* t. i. pp. 17, 18.

† "Dici et ego circa methodum naturalem inveniendam elaboravi; bene multa quæ adderem obtinui; perficere non potui, continuaturus dum vixero. Interim quæ novi proponam. Qui paucas quæ restant benè absolvit plantas, omnibus MAGNUS ERIT APOLLO." *Class. Pl.* p. 485.

blishment of his natural orders, and by his learned dissertations prepared the way which led to the perfect knowledge of vegetable productions*."

Now if, by these and similar observations, it be meant merely to prove that Linnæus was fully convinced of the importance of studying the natural affinities of plants, and that he considered it as the highest department of the science, there can be no difficulty in acceding to them; but if they be intended to show that he was of opinion that any arrangement of plants on a natural system was to be preferred to, and might supersede the use of, his own artificial arrangement, (and if this was not the object in view, the introduction of the concessions of Linnæus is of no avail,) it may justly be observed that these authors have either mistaken or not fairly represented the meaning of Linnæus.—That natural affinities are to be studied, and that this department of the science cannot be too diligently cultivated, was his decided conviction. He has even frequently contemplated the possibility of an arrangement which should include in their natural orders the whole vegetable kingdom; but in alluding to such an event, it was always as a mere possibility, of the completion of which he had scarcely a distant hope: still less would he have been inclined to admit that any such arrangement, even if it could be formed, could supersede that which he had with so much assiduity demonstrated, and to which he invariably adhered to the close of his life. To collect together detached sentiments from his writings for the purpose of proving that he preferred a natural method to his own, as a general arrangement, is to pervert his opinions, to render him the adversary of his own labours, and the suicide of his own fame. To the firm and inflexible conviction of the practical superiority of his own method, all the

* *Ventenat, Discours,* p. 19.

passages

passages cited by these writers are strictly reconcileable; but if any doubt remained on this subject, it would readily be dissipated by a reference to his works. Even in the brief introduction to his own fragments of natural orders, he has placed it in so clear and perspicuous a light, that it is impossible to mistake it. "Natural orders," says he, "cannot constitute a method without a key. In distinguishing plants, the artificial method is alone of any avail; a natural method being scarcely, or rather not at all, possible. Natural orders are useful in acquainting us with the nature of plants, but an artificial method is requisite to their discrimination*." And to this he has added, in language that must for ever remove all ambiguity on this head, "Those persons who, instead of a natural method, have arranged plants in fragments of such a method, and reject an artificial one, seem to me to resemble those who, having a convenient and well roofed house, overturn it, in order to build one in the place of it of which they are unable to finish the roof†."

That Linnæus has in many parts of his works highly commended those who have distinguished themselves in investigating the natural relations of plants, is certain; but to suppose that by this he meant to approve of those who pretended to have formed a natural arrangement, is to attribute to him an opinion which he has disavowed in the most pointed terms. "A real botanist," says he, "will investigate the natural order of plants when it can be discovered;" but, "he will not boast of having

* "Ordines naturales non constituunt methodum absque clave.

"Methodus artificialis itaque sola valet in diagnosi, cum clavis M. naturalis vix ac ne vix possibilis sit.

"Ordines naturales valent de natura plantarum—Artificiales in diagnosi plantarum."

† "Qui loco methodi naturalis disponunt plantas secundum ejus fragmenta, *respuuntque artificialem*, videntur mihi iis similes, qui commodam et fornicatam domum evertunt; inque ejus locum reædificant aliam, sed tectum fornicis conficere non valent."

discovered:

discovered a system perfectly conformable to the laws of nature*." And among his diagnostics of pretended botanists he particularly includes that of "presuming that they are acquainted with a natural method†."

Instead of dwelling further on the endeavours of the French botanists to invalidate the labours of Linnæus by resorting, as Ventenat has done, to the well-known censures of Haller and others, I shall in the sequel of this paper endeavour to ascertain the relative merits of the two systems which now principally offer themselves to our acceptance; in which I shall attempt to show,

I. That the method of Jussieu is not in fact a natural, but an artificial one.

II. That, as an artificial method, the system of Jussieu is inferior to that of Linnæus.

III. That the artificial and natural methods of arrangement are, and must always remain, essentially different from each other, as well in the means employed as in the objects to be attained.

I. Could we suppose it possible for a person to be born with some superior instinct, which enabled him to decide at first sight on the character of a plant, and the genus and order to which it belonged, we might perhaps be induced to assent to his decisions, and allow him arbitrarily to establish his system. But, even with this conviction on our minds, circumstances might arise to shake our belief in his infallibility; and if, like Bernard de Jussieu, he should, in one short order of only eight genera, unite together the *Bromelia* and the *Hydrocharis*, the *Musa* and the *Galanthus*, we should perhaps feel inclined to ask upon what

* "*Botanicus verus*, ordinem naturalem, ubi patet indigitet."—*Regn. Veget.* 27.
"Nec naturalissimam structuram oratorio sermone ebuccinat."—*Phil. Bot.* p. 294.

† "Botanophili Fallaces—Methodum naturalem sibi notam crepant."—*Regn. Veget.* 27.

similarity

similarity in the flower, root, or seed, he had founded his opinion.—Nor would it be sufficient for the ends of science, if the decisions of this superior being were always free from error. For this purpose, we must not only know, but must be enabled to communicate our knowledge to others; and how this could be done, without our giving some specific reasons for our convictions, and for the assent to them which we claim, it is not easy to conceive.

These difficulties were perceived by the younger Jussieu; who, instead of giving us a mere list of genera, arbitrarily arranged in orders, characterized from some one of the principal genera in each order, has condescended to explain the grounds of his opinions by an arrangement or system, founded on the visible and tangible parts of the plants themselves. From this moment it was evident that no supernatural intelligence had dictated the arrangement; which, notwithstanding its more imposing title, was to be judged of, like all other arrangements, only by its superior ingenuity, accuracy, and utility. It might indeed be more skilfully executed than the system of Linnæus; but still it appealed to the same organs of sense, and submitted to be judged by the same rules.

In one view of the subject, all modern systems may indeed be denominated natural, as they are all deduced from some part, property, or peculiarity, of the plants themselves: those of Morison, Ray, Herman, and Gærtner, from the fruit; of Tournefort, Knaut, and Rivinus, from the corolla; of Magnol, from the calyx; that of Linnæus, chiefly from the number, proportion, and situation of the stamina; and that of Jussieu, from the mode of germination, and situation of the stamina; but principally, like that of Tournefort, from the number and disposition of the petals. It is true, that some of these methods may

be

be greatly preferable to others; but it is equally true, that there is scarcely one of them that does not possess some advantages which the others do not afford, and which have induced their respective authors to give them the preference. Some of them may even approach nearer to a natural system than the rest; or, in other words, may occasion less separation among plants which have a real affinity: others may pay less regard to this object, and may in some degree sacrifice it for the purpose of giving a more correct, extensive, and intelligible nomenclature; but the distinctions on which they are founded are equally natural; although it may not be possible for any method that is confessedly founded upon the sensible phænomena of the vegetable kingdom, whatever its pretensions may be, to unite together the families of plants in the strict natural orders and relative situations, or occasionally to avoid separating those which the general convictions of our senses assure us ought to be united.

If however it be still asserted that the system of Jussieu is to be preferred, as exhibiting a more exact conformity to the affinities of nature than that of Linnæus, may we be allowed to ask upon what this superiority is founded, and in what particular part of the system it consists? Are the affinities of plants more likely primarily to result from the petals, or from the stamina? from the part which shelters the immediate organs of reproduction, or from those organs themselves, connected as they are with the very nature and fructification of the plant? Supposing a doubt to arise whether a plant ought to be arranged with such as agreed with it in the corolla, or in the stamina, how would a skilful naturalist be inclined to decide? or which would he consider as the most powerful affinity? In whatever manner the orders of the two Jussieus may have been formed, they exhibit,

at

at least, as many incongruities to the general observer, as the classes and orders of Linnæus. What would such an observer, unacquainted with the secret chain employed by these authors, say to the union in the same class of the *Palmæ* with the *Junci?* the *Musæ* with the *Hydrocharides?* the *Proteæ* with the *Atriplices?* the *Jasmineæ* with the *Scrophulariæ?* the *Rhododendra* with the *Campanulaceæ?* or, in short, to the many tribes apparently wholly discordant from each other, in conformation, in habit, in qualities, which occur in almost every class? Can the system of Linnæus exhibit any associations more revolting to his conceptions, or which would tend more decisively to convince him that, whatever may be their pretensions, these systems are in fact equally artificial, and that their assumed natural affinities are nothing more than a partial resemblance, founded on some peculiarity of habit or conformation, which may serve to decide its situation in a nomenclature, but has often little or no relation to the real and essential nature of the plant?

II. If such be the fact, our inquiry will now take a different shape. It is no longer a question as to the superiority of one system over another, but a question of degrees as to the superior execution of a similar method. Let us then, whether we choose to denominate them both natural or both artificial, briefly compare the rival arrangements of Linnæus and Jussieu.

The most important difference between these two methods consists in a preliminary distinction made by Jussieu, by which he divides the vegetable kingdom into three departments, to each of which he applies a separate mode of arrangement, whereas Linnæus applies his method indiscriminately to the whole. By the plan of Jussieu we are in the first place to ascertain whether the plant which we examine rises from the seed without a cotyledon,

with one cotyledon, or with two cotyledons*; and having determined this point, we then proceed by other rules to distinguish the individuals in each department. By that of Linnæus we take the plant without any regard to its mode of germination, and from the parts of fructification immediately determine its character, and assign it to its proper genus. That the mode in which plants arise from the seed†, or, more strictly speaking, that the seed itself, of which the cotyledons are formed, affords a true natural distinction, cannot be doubted; but in estimating the advantages of this distinction, we must also estimate its disadvantages, and form our decision upon the whole result. The object attained by Jussieu is the separating from the great mass of vegetables, two portions; one of which, the acotyledones, comprehends the cryptogamous

* This distinction it may be observed was made by Linnæus himself, as the foundation of his *Regnum Vegetabile*; with the necessary and indeed indispensable addition of the *Polycotyledones*.

" Tribus vegetabilium tres vulgo numerantur.

Monocotyledones.	Fruges 1. 2. 3.
Dicotyledones.	Plantæ 4. 5.
Polycotyledones.	Rhizophora.
Acotyledones.	Cryptogamæ 6. 7. 8. 9."

Linn. Reg. Veg. 3.

† In his *Philosophia Botanica*, Linnæus has carried this method much further than Jussieu has done; having divided the Monocotyledones into

perforatæ.	Gramina.
unilaterales.	Palmæ.
reductæ.	Cepa.

And his Dicotyledones into

immutatæ.	Legumina &c.
plicatæ.	Gossypium.
duplicatæ.	Tetradynamia &c.
obvolutæ.	Helxine.
spirales.	Salsola &c.
reductæ.	Umbellatæ.

And in his Polycotyledones he enumerates Pinus, Cupressus, and Linum, p. 102.

plants

plants of Linnæus, and forms the first class of Jussieu: the other, the monocotyledones, includes the gramineous and liliaceous plants, and forms the second, third, and fourth of his classes. These distinctions may be admitted to be well founded*; but what are the advantages they afford over those of Linnæus? who has also referred the Cryptogamous Plants to a distinct class by a peculiarity equally natural, the inconspicuity of their flowers, and with a few exceptions, not perhaps difficult to have been avoided, has arranged the gramineous and liliaceous plants in orders as natural as those of Jussieu.

In this respect, then, the two systems are nearly upon an equality; and to say the truth, it was almost impossible for any naturalist, upon a subject where the grounds of distinction were so numerous and so manifest, to adopt a different conclusion. But if nothing be gained in this instance by Jussieu, can we also say that nothing is lost? Is it no disadvantage, on discovering an unknown plant, to be under the necessity, before we proceed to its further investigation, of ascertaining in what manner it commenced its growth, and whether it rose from the seed with one or with two cotyledons, or without any cotyledon whatever? To whom are we to apply for this information? Or are we to be turned round to ascertain the primary distinction by the sensible

* Yet it must be observed that in the numerous tribe of the *Orchideæ*, which Jussieu has arranged among his Monocotyledonous Plants, others have not been able to discover the slightest trace of a cotyledon. For instance, "ORCHIS MORIO. Acotyledoneus, ne vel minimo placentæ rudimento unquam exserto."—"LIMODORUM VERECUNDUM. Embryo minutus, acotyledoneus." V. *Salisbury in Linn. Trans.* tom. vii. pp. 31, 32.—Again, some plants have been discovered to have more than two cotyledons, as in *Pinus*, and *Dombeya*; the cotyledons of the latter of which "are distinctly four." *Smith's Introd. to Bot.* pp. 98. 289. And even the Mosses are said to have numerous seed-lobes, "so that these plants are very improperly placed by authors among such as have no cotyledons." *Ib.* p. 190.

 appearance,

appearance, and instead of saying that the plant rose from one cotyledon and is therefore a grass, that it is a grass and therefore rose from one cotyledon? At all events, it imposes a difficulty on the student without affording an adequate advantage, and throws a doubt over the great mass of individuals of the vegetable kingdom, to be removed only by inquiring into the mode of their early growth, in order to separate from the rest some detached plants which are equally as well separated by other distinctions quite as natural and more permanent, and which it is indeed impossible should be confounded with them.

This peculiarity in the method of Jussieu being considered, the two systems, as far as they regard the great mass of the vegetable kingdom, may now be placed in more direct comparison. Linnæus has founded his primitive distinctions on the number and proportions of the stamina; not omitting the diversities arising from their situation. Jussieu, disregarding in his primary distinctions the number of the stamina, has recourse merely to their situation, which he distinguishes into three different manners, as being placed upon, around, or below the germen, under the appellations of *Epigyna*, *Perigyna*, and *Upogyna**. This distinction is applied however only to his apetalous and polypetalous plants, the monopetalous plants being distinguished not immediately by the stamina, but by the situation of the corolla. This necessarily compels him to commence his definitions by the corolla, and accordingly he first divides his dicotyledonous

* With respect to these distinctions, the most important in the arrangement of Jussieu, the reader (μόνον Ἄρρην ἔστω) may consult Mr. Salisbury's "Observations on the Perigynous Insertion of the Stamina of Plants;" where he has undertaken to show that such perigynous insertion is entirely factitious, and that there is no instance whatever, in the whole vegetable kingdom, of stamina being inserted in the calyx. V. *Trans. Linn. Soc.* vol. viii. p. 1.

plants

plants into *apetalous*, *monopetalous*, and *polypetalous*. Of these the apetalous are to be again subdivided by the stamina, which are considered with respect, not to the number, but the situation; and as in the absence of the corolla the stamina are inserted *directly* into the style or germen, this is denominated the *absolutely immediate insertion* of the stamina, constituting the fifth, sixth, and seventh, of his classes. The *monopetalæ*, distinguished into separate tribes by the corolla, which is for the most part staminiferous, and is therefore said to exhibit the *mediate insertion* of the stamina, form the eighth, ninth, tenth, and eleventh classes; and the *polypetalæ*, characterized again by the situation of the stamina, the insertion of which is here called *simply immediate*, as it *accidentally* varies at times into the mediate insertion, or in other words is found sometimes on the germen and at others on the corolla*, form the twelfth, thirteenth and fourteenth of his classes; his fifteenth and last being composed of diclinous or irregular plants, not properly reducible to any other head.

Independent, therefore, of the distinctions arising from the cotyledons, which, however well founded, have been shown to be of little practical utility, the system of Jussieu is the system of Tournefort; in which Jussieu has, it seems, discovered advantages resulting from the incidental connection between the stamina and the corolla, of which Tournefort himself was not aware†. It must

* "Insertio immediata vel est *absoluta* in mediatam mutari nescia, dum corolla supprimitur, ut in apetalis; vel est *simplex*, in mediatam *fortuitò* mutabilis, dum corolla existens non gerit stamina, et tamen ferre interdum potest, ut in plerisque polypetalis," &c. *Juss. Gen. Pl.* p. 79.

† "Tria inde eruuntur signa primaria, ferè essentialia ac cæteris spectabiliora, jam in Tournefortianâ methodo feliciter adhibita, singula ter dividenda a situ staminum in apetalis et polypetalis, corollæ in monopetalis." *Juss. Gen. Pl.* p. 80.

"On retrouve donc ici une des grandes divisions de Tournefort prise de la corolle, organe très secondaire en lui-même, mais qui, par son union avec un organe principal et essentiel

must also be observed that the primary distinctions of Linnæus extend at once through the twenty-four classes, whilst those of Jussieu, arising from the cotyledons, extend only to three; the secondary, founded on the corolla, form only three more; and the subdivisions of these by the *stamina* and *antheræ*, including the anomalous class of *Diclines irregulares*, form in the whole only fifteen classes, thus obtaining much less in point of distinction by four separate processes than Linnæus has obtained by one.

The consequence of this is, that there are on an average a much greater number of plants in each of the classes of Jussieu than in those of Linnæus. In order to designate these classes, Linnæus has recourse solely to the stamina, from the number, proportion, and situation of which he has formed all his distinctions, which he has comprised in one single expressive word, fully indicative of the grounds upon which the class is founded. Jussieu, on the contrary, in order to arrive at the distinctions of his classes, has taken a more circuitous path, and instead of referring to a single part, and defining it by a single word, has recourse to various peculiarities, as well in the mode of germination as in the fructification. Thus the compound flowers, forming a natural order, are designated by Linnæus by the term *Syngenesia*; whilst Jussieu denominates them *Plantæ dicotyledones, monopetalæ, corolla epigyna, antheræ connatæ.* To say nothing of the inconveniencies introduced into the science by the substitu-

essentiel *dont Tournefort n'avoit pas connoissance*, se trouve passer au premier rang." *Extrait des Registres de la Soc. Roy. de Med. à Paris.*

But had Jussieu preserved a strictly natural method, he would have adopted the distinctions on the cotyledons, as suggested by Linnæus. In deserting these he has evidently fallen into an artificial one, having no connection whatever with the foundation on which his system is built.

tion

tion of a long definition for an appropriate appellation, the consequence of this diversity in the two systems is in other respects important. The separation of the vegetable kingdom into classes is only one step towards an arrangement. The subordinate divisions of orders and genera require other distinctions. It becomes necessary, therefore, not to expend, as it were, in the formation of the classes those peculiarities which may be applied with so much effect, and which are indeed indispensable in the subordinate arrangements. Of this Linnæus was fully aware; and he has accordingly reserved for this purpose, not only certain particularities in the situation of the stamina, but the whole advantages arising from the corolla, calyx, and nectarium; and, what is of still greater moment, the distinctions dependent on the number and form of the style and stigma. Jussieu, on the contrary, has prematurely deprived himself of many of these distinctive characters, although from the greater magnitude of his classes he has greater occasion for them. Those which arise from the number of the petals, as well as the situation of the stamina, he has applied to the formation of his classes, and in some instances, as in his tenth and eleventh classes, has even resorted to the antheræ for these leading distinctions. The consequences of this will more fully appear by a brief comparison of these arrangements in their subordinate divisions.

According to each of these systems, the classes are divided into orders. Linnæus, still aiming at simplicity, but founding his decisions on strong natural distinctions, has for this purpose recourse to the pistillum, or style, the immediate organ of impregnation, and essential to the formation of the fruit. As a single word has expressed the class, so another word now gives us the order; and to a practical botanist the expression *Pentandria monogynia* suggests the idea of a division of plants including, among

among many others, the natural order of asperifoliæ; as that of *Pentandria digynia* does of the umbelliferæ. The difficulties under which Jussieu labours now become apparent. He has indeed formed the vegetable kingdom into fifteen classes; under which heads he has arranged one hundred tribes or orders, each consisting of various families of plants supposed to be allied to each other; but when we ask for the distinctions of these orders, or, in other words, by what peculiarities they are to be recognised, and in what terms they are to be described, we find only a series of appellations, mostly derived from some particular genus of plants which is supposed sufficiently predominant to give a name to the order, and which order includes certain other genera which appear to be related to it*. If, however, we are dissatisfied with this mode of distinction, as affording us no determinate idea, nor giving us any clue to discover how such order is formed, we can only have recourse to a comparison of the descriptions placed at the head of each of the orders of which each class is composed. That the Jasmineæ may form a part of the same natural *class* as the Gentianæ, although their relation be not very apparent, may be admitted; because they equally germinate from two cotyledons, and have each a monopetalous corolla, situated beneath the germen: but when we ask why these genera are not also of the same order, we must seek for an answer in the description prefixed to each order in the body of the work; until by a careful perusal and comparison of these descriptions, which in many respects agree, we are at length enabled to determine in what the difference between a Jasmine and a Gentian, a Laurus or an Atriplex, really consists. In this

* Thus th e4th order of the 8th class is denominated *Jasmineæ*, and includes the genera of Maytenus—Nyctanthes—Lilac—Hebe—Fraxinus—Chionanthus—Olea—Phillyrea—Mogorium—Jasminum and Ligustrum.

secondary

secondary part of the system it will therefore scarcely be denied that the advantages of perspicuity and precision are wholly on the part of Linnæus, whatever may be the case as to the natural order of the plants; in which respect, however, it is by no means clear that Jussieu possesses any superiority over his predecessor.

From classes and orders we descend to genera, in the determination of which the chief difficulties of the science consist; but as in some of the orders the number of genera is very great, it has been found indispensably necessary to divide such orders into sections, so as to place each genus in its proper relative situation, and break in as little as possible upon their natural or apparent affinities. This Linnæus and his subsequent editors have endeavoured to do by a kind of collateral arrangement placed at the head of each class, though not strictly conformable to the rest of the system. For the discrimination of these sections there remained ample materials. The stamina and pistils had indeed already been employed in characterizing the classes and orders; but the corolla, as well with respect to the number of its petals as its form and situation, the calyx, the receptacle, the germen, the stigma and the fruit, all offered important marks of discrimination, which have been made use of so as greatly to assist the student, although not with all the beneficial effect that might have been expected, or so as to define with accuracy the relative situation of each genus. The same mode of dividing the orders into sections has also been resorted to by Jussieu; but as he had already employed the corolla and the situation of the stamina in order to characterize his classes, he has been obliged to have recourse in his subordinate divisions to other distinctions. He therefore chiefly employs for this purpose the number of the stamina, and the style, with the addition of the receptacle, and particularly of the fruit. Thus it appears

that the two systems of Linnæus and Jussieu are in this respect nearly a transposition of each other; and that whilst Linnæus begins his great divisions with the essential organs of fructification, and proceeds to characterize his inferior divisions by parts of less natural importance, Jussieu has formed his leading distinctions upon the corolla, and the situation of the stamina; and has employed the number of the stamina and style to divide his orders into sections. Which of these methods is to be preferred the reader will decide; but as they are in fact equally natural, or equally artificial, that which most clearly defines the plant in question, which supplies a concise and intelligible nomenclature, and most effectually assists the student in his researches, is undoubtedly to be preferred: and in these respects it will scarcely be contended that the system of Jussieu is superior to that of Linnæus.

In forming their genera both Linnæus and Jussieu have exerted all their talents. They were both of them equally convinced that these combinations were founded in nature, and ought equally to be adhered to under every mode of arrangement. Here then there can be no comparison, except as to the superior skill exhibited in the composition and description of such genera. Which of them has excelled in this respect I shall not take upon myself to decide; but if the preference is to be given to Jussieu in any instance, it is perhaps in the full and scientific manner in which his genera are defined.

But whatever may be the merits of these rival systems in other respects, there is one objection still remaining against that of Jussieu, which strikingly reminds us of the prediction of Linnæus, and renders it as a nomenclature entirely useless. Unable to comprehend in any of his divisions all known genera, he is compelled to annex to the close of several of his orders many plants,

which

which he denominates *genera affinia ;* besides which, he is obliged to add at the end of his work a long appendix of plants whose proper stations he has not been able to ascertain ; not from the want of opportunity for investigation, for many of the plants were obvious ; but because they either fall under different classes with equal claims, or are not reducible to any class whatever. As a nomenclature this defect is fatal ; for, unless the inquirer can be confidently assured that some part of the system will afford him the information he requires, he is disheartened in his efforts, and relinquishes his search in disgust.

Here, then, the comparison between these rival systems necessarily terminates ; and whatever may be the merits of Jussieu as a botanist, it is sufficiently clear that they are not exemplified in the superiority of his arrangement as a nomenclature of the vegetable kingdom. In fact, the inconveniencies arising in such arrangement from its primary distinctions being founded on the mode of germination, from the want of a succinct and explicit division of the classes into orders and sections, and particularly from the unfortunate circumstance of a considerable portion of vegetables not being included in any part of the system, compel us to conclude that, as a nomenclature and series of plants, it is greatly inferior to that of Linnæus ; and that, however excellent it may be in some respects, it will never supplant in general use that long established work.

III. That the work of Jussieu, considered as an illustration of the natural affinities of plants, possesses great and intrinsic merit, we may however readily admit ; but that the study of plants in their natural orders can supply the want of an artificial system, may safely be denied. In fact, these two methods are as distinct in their objects as they are in their means, and should never be

confounded with each other. The one commences its observations with the obvious and exterior appearances of plants; and, seizing upon the most striking characters, immediately arranges them into their different classes and families. No distinctions are employed but such as are visible, and present; and wherever the plant is seen in its perfect state, it bears upon it its own name and character. As the means thus employed are confined to the exterior of the plant, so the object in view is limited to the mere knowledge of its proper appellation; and as soon as that is attained, the purpose of an artificial system is complete.—A *real* natural system, on the other hand, if such a one should ever be practicable, must be founded on a long and intimate acquaintance with the nature of plants, their habits and places of growth, the form and qualities of their seed, the manner of their evolution, increase, and reproduction, the peculiarities of their radication, their interior substance, whether medullary or concentric, the infinitely varied formation of their vascular system, by which the plant is not only enabled to circulate the juices necessary to its support, but to elicit those peculiar qualities of acids, salts, gums, resins, and aroma, by which they are distinguished, and on which their natural combinations so ultimately depend. When these facts are sufficiently developed, the system then proceeds to arrange the individuals of the vegetable kingdom, not by their exterior phænomena, but by those primitive and secret alliances by which nature has bound them together; uniting such as are most nearly allied, and separating such as have no inherent affinity to each other. In an artificial system, some plain and obvious distinction, such for instance as the number of the stamina, is decisive of the character. In a natural system this must depend on some more remote circumstance, such as the mode of germination of the plant, and which, though deeply founded in nature,

cannot

cannot at the instant be demonstrated, but must for the present be admitted on the credit of the founder. Even to determine the primary distinctions on which such a system should rest, is a matter of no small difficulty: and notwithstanding the concurrent authority of both Linnæus and Jussieu, it is by no means certain that the number of cotyledons with which a plant germinates is the most secure foundation; or whether, for instance, the classification by Gærtner from the seeds themselves is not to be preferred. Hence there arises between the two modes of arrangement this important distinction, that an artificial method, devised and completed by one person, may readily be communicated to another, and is as intelligible to the student as to the preceptor; whilst, on the contrary, the knowledge of a natural system is chiefly confined to the author, and cannot be fully attained by any other person without entering into the same investigations, and ascertaining the same facts; many of which might perhaps afford different results, or lead to different conclusions. Whenever a pretended natural system relinquishes these primary distinctions, and attempts to arrange the genera and species of plants by their exterior phænomena, it is no longer natural but artificial; and the superstructure being wholly different from the basis, it becomes incongruous and absurd; neither furnishing the recondite information which is obtained from the study of the natural relations of plants, nor affording us those advantages of a ready discrimination which we derive from an artificial arrangement. As long as these truths are acknowledged and acted upon, a real progress will be made in the science; and to no country has the world been of late more indebted than to France, for that knowledge and information which a deep inquiry into the recesses of the vegetable kingdom can alone supply; although this country may also boast of many distinguished followers.

lowers. It is however to be regretted, that these eminent men have either not been aware of the true limits of the science which they cultivate, or have not been satisfied to confine their efforts within the bounds which it prescribes; but have endeavoured to establish their system as capable of exhibiting a complete arrangement of the vegetable kingdom, which would render unnecessary all the labours of their predecessors; and still more is it to be regretted, that they should have endeavoured to establish such an opinion on the authority of Linnæus himself, and should have represented him as speaking a language the most foreign from his thoughts, and as having condemned a system which he laboured with incessant assiduity to establish, on which his hopes of fame were in some measure founded, and which will certainly not defraud him of those honours which are so justly his due.

V. *Remarks*